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RECOMMENDATIONS FOR SELECTION OF DAIRY FLOOR FINISHES

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RECOMMENDATIONS FOR SELECTION OF DAIRY FLOOR FINISHES

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 24 December 1975, after the draft finalized by the Flooring and Plastering Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 Floors in dairies and other premises used for processing milk are subjected to heavy impact, abrasion and chemical attack. Selection of suitable floor finishing materials and design of drains are, therefore, important for low maintenance cost and long life of the floor. The selection of different floor finishes has also to be related to the design of the structural floor and its protection by providing suitable damp-proof treatment. For small dairies, processing up to 10 000 litres of milk per day floor finishes other than those specified in this standard may also be provided.

0.3 In the formulation of this standard due weightage has been given to international co-ordination among the standards and practices prevailing in different countries in addition to relating it to the practices in the field in this country.

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1. SCOPE

1.1 This standard covers the selection of dairy floor finishes, where the floor is subjected to heavy abrasion and impact from machinery and attack from milk and milk products and detergents used in cleaning the floor. Guidance is also given for selection when the floor finish under special circumstances should be non-slippery, dustless, noiseless and capable of being easily cleaned.

2. GENERAL REQUIREMENTS OF DAIRY FLOOR FINISHES

2.0 The following are the general requirements of dairy floor finishes:

a) The floor finish should be capable of withstanding heavy impact, abrasion and vibration from machinery;
b) It should be resistant to mildly corrosive liquids;
c) The floor finish should have a surface which is easily cleaned and is non-slippery even when wet;
d) The floor finish should present good hygienic conditions; and
e) The floor finish should be capable of being repaired quickly.

3. STRUCTURAL BASE IN DAIRY FLOOR

3.1 The structural base is usually of concrete (*see* IS : 2571-1970*) or reinforced concrete suitably designed, although structural steel may be found useful for suspended floors. A concrete structural base may be cast as a floor directly on the ground, or it may be suspended slab cast *in situ* or be constructed from precast concrete units. It should be designed to withstand all the static and dynamic stresses likely to be imposed.

3.1.1 The structural base should be constructed in such a manner so that a slope of not less than 1 in 80 is imparted to the floor surface. This fall should be such that liquid spillage on the floor surface will be carried quickly to the nearest drain by the shortest route. It is essential to have a waterproof membrane (*see* **5**) between the base and the floor finish. The joints in the structural base shall be provided in accordance with the details given in IS : 3414-1968†. All laitance should be removed from the top concrete base and the surface roughened before laying the floor finish.

4. FLOOR FINISHES FOR DIFFERENT SECTIONS OF A DAIRY FLOOR

4.1 Group I — This group consists of the following sections:

a) Loading dock or dispatch dock, and

b) Cold storage room.

4.1.1 These sections are subjected to very heavy impact and abrasion. Spillage of milk and milk products also takes place. Floor finishes recommended for these sections are steel or cast iron tiles or solid steel plates. The floor finish of steel or cast iron tiles may be supported structurally by sub floor. Solid steel plates may be used as a structural finish supported on an under-floor frame work.

4.2 Group II — This group consists of the following sections:

a) Milk can reception room,

b) Empty can and bottle reception dock, and

c) Empty can and bottle washing room.

4.2.1 These sections are subjected to heavy impact and abrasion, but little spillage of milk and milk products. Floor finishes recommended for these sections are steel or cast iron tiles or metal grids with filling materials, such as, cement concrete, cement-rubber latex, etc.

*Code of practice for laying *in situ* cement concrete flooring (*first revision*).

†Code of practice for design and installation of joints in buildings.

4.2.2 There are two main types of metal tiles used for industrial purposes which are suitable for dairy floors. They withstand impact, abrasion and resist the action of alkalis but are liable to be attacked by weak acids.

4.2.2.1 One type usually called an anchor plate is in the form of a shallow tray, made of steel. The wearing surface is punched to give twisted anchors or grips which form the key for the bedding and when bedded in the concrete give a floor which is generally 40 mm thick. A typical illustration of such a tile is shown in Fig. 1. It is essential for the success of this type of floor finish that the tiles are completely filled with concrete. Tiles which are not solidly bedded give continuous trouble because the steel is not strong enough to bridge hollow places and is bent under traffic.

4.2.2.2 Another type of tile is called honeycomb cast iron tile. These type of tiles are manufactured with a taper in honeycomb for better grip with concrete. A typical illustration of such a tile is shown in Fig. 2.

4.2.3 Metal grids are frequently used as a surface reinforcement to increase the impact resistance. The grids may be of cast iron or steel and of hexagonal or square mesh. The usual matrix into which they are laid may be either granolithic concrete (IS : 5491-1969*), or cement-rubber latex. The grid may be supplied either as a roll of interlocking metal strips from which a grid can be formed or as small mats. Mats framed on two sides only are best because this avoids the weak joints between the sections. The top edges of the grid form part of the wearing surface of the floor and distribute impacts and wear. Because of uneven wear between the grid and the material in which it is embedded such floors may become noisy in use.

4.3 Group III — This group consists of the following sections:

a) Milk dump tank pit;
b) Milk storage room;
c) Processing hall, milk pasteurisation section;
d) Butter, ice-cream, cheese and ghee sections;
e) Milk filling section;
f) Roller drier room;
g) Tonned milk room;
h) Corridors; and
j) Laboratory rooms.

*Code of practice for laying *in situ* granolithic concrete floor topping.

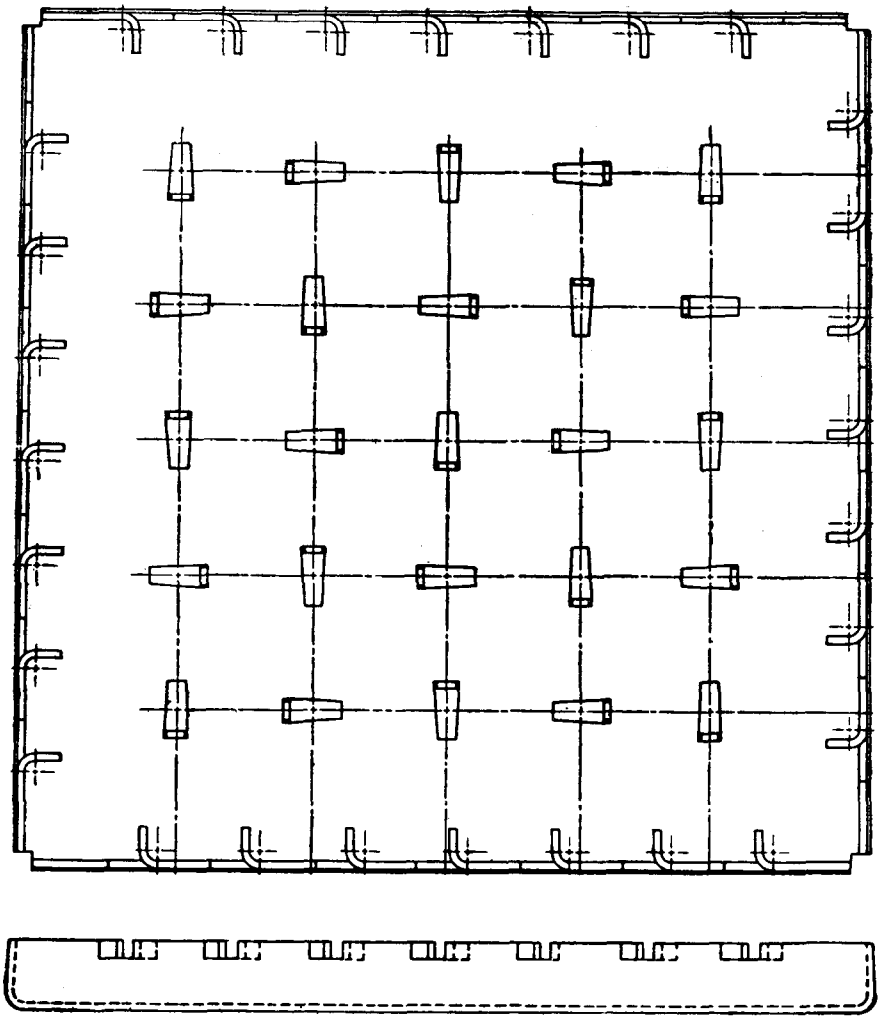

FIG. 1 ILLUSTRATION OF ONE OF THE TYPICAL STEEL FLOORING TILES FOR DAIRY FLOORS

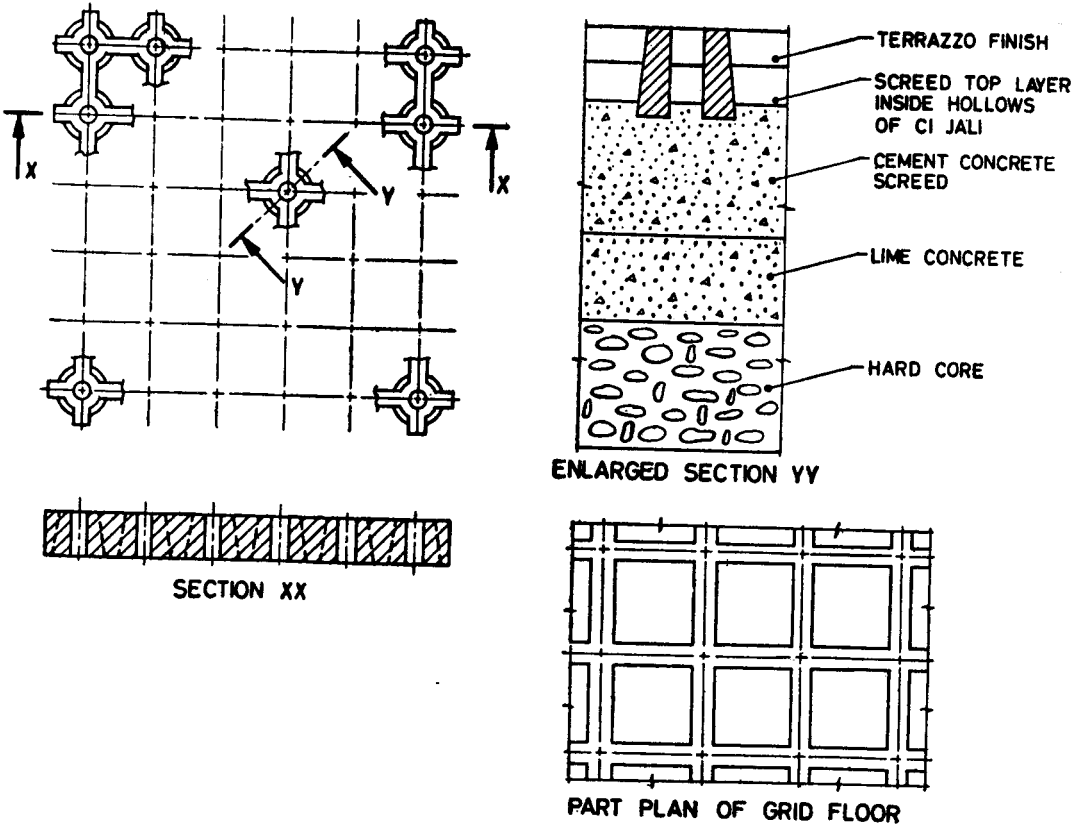

FIG. 2 ILLUSTRATION OF ONE OF THE TYPICAL HONEYCOMB CAST IRON TILES

4.3.1 Floor finishes in these sections should be resistant to normal impact and wear, to frequent spillage of milk and milk products, and to mild acids particularly organic acids, and alkalies and good resistant to hot and cold water as the floors are subject to frequent washing. The general choice may be made from the types of floor finishes given in **4.3.2** to **4.3.5**.

4.3.2 Portland cement concrete is slowly attacked by milk and milk products particularly by lactic acid and therefore is not suitable for these sections. However, in such areas where acidic action is not predominant, cement concrete flooring tiles conforming to IS : 1237-1959* or stones such as *kotah* stones may be used.

4.3.3 *Acid and Alkali Resistant Stones Laid with Phenolic Type Resin Mortar [IS : 4832 (Part II)-1969†] for Bedding and Jointing* — Sand stones of highly siliceous and compact variety containing low quantity of aluminium oxide, calcium oxide and magnesium oxide, etc have good acid and alkali resistance quality. Such stones are generally found in places like Dholpur, Gwalior, Rewa, Cuddapah and Mandana, etc. The stones may be tested for acid resistance in accordance with the methods described in IS : 4457-1967‡. However, a maximum of 4 percent weight loss during acid treatment may be accepted as adequate acid resistance for the purpose of dairy floors. These floors give long life but become slippery in due course and hence would require periodical roughening.

4.3.4 *Ceramic Unglazed Vitreous Acid Resistant Tiles or Acid Resistant Bricks* — Vitreous ceramic tiles (IS : 4457-1967‡) or acid resistant bricks (IS : 4860-1968§) could be conveniently used for the floor finish. These tiles and bricks would provide over a long period, good resistance against acidic conditions provided by milk and milk products. These materials would also offer adequate resistance against the mild alkaline conditions provided by washing soaps and detergents, etc.

4.3.4.1 The life of a good quality brick or tile floor is largely determined by the material used for the bedding and jointing and to some extent by the width of the joints. Hence, careful selection shall be made in the choice of the bedding and jointing mortar, and the thickness of the joints. Whatever be the choice of the mortars these should necessarily show adequate bond strength when tested according to IS : 4456 (Part I)-1967||.

*Specification for cement concrete flooring tiles.
†Specification for chemical resistant mortars : Part II Resin type.
‡Specification for ceramic unglazed vitreous acid-resistant tiles.
§Specification for acid-resistant bricks.
||Methods of test for chemical resistant mortars : Part I Silicate type and resin type.

4.3.4.2 For bedding and jointing mortars, selections may be made from the following:

a) Chemical resistant resin type mortars [*see* IS:4832 (Part II)-1969*]

b) Rubber-latex cement mortars, and

c) Supersulphated cement (*see* IS:6909-1973†) or Portland blast-furnace slag cement (*see* IS:455-1967‡).

4.3.4.3 Among the resin based chemical resistant mortars, epoxy resins and phenol formaldehyde type [*see* IS:4832 (Part II)-1969*] are quite suitable as jointing mortar.

4.3.4.4 Sodium silicate or potassium silicate acid resistant mortars [*see* IS:4832 (Part I)-1969§] although have good acid resistant properties under dry conditions, are not suitable as jointing mortars in these sections of the dairies as these mortars are slowly attacked by cold water and rapidly by hot water. However, these may be used as bedding mortar in conjuction with resin type jointing mortar.

NOTE — For properties of these jointing mortars reference is drawn to Table 5 of IS : 4971-1968‖.

4.3.5 *Jointless Cement-Latex Rubber Finish* — This is prepared from a mixture of rubber latex or synthetic rubber and Portland or Portland slag cement. The resistance of these mixes to milk products is generally much higher than that of the corresponding mixes without latex. The choice of the type of latex will also determine the properties of the floor, such as water tightness and resistance to oil. The technique of mixing and laying is different than that of ordinary concrete and therefore advice of an expert, would be required when using these floor finishes.

NOTE — The latex normally takes the form of a dispersion in water of natural rubber latex, but for a special circumstance, for example, for oil resistance, synthetic rubber may be used.

4.3.5.1 The latex is stabilized against premature coagulation. It should not contain vulcanizing ingredients. If these are required they should be incorporated at the time of preparing the mixture.

4.3.5.2 The emulsion is diluted with water as required and is then mixed with cement and aggregate to form a mix of the desired rubber latex content. The proportion of the rubber latex used varies from 8 to 25 percent by weight of the total mix.

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*Specification for chemical resistant mortars : Part II Resin type.
†Specification for supersulphated cement.
‡Specification for Portland blastfurnace slag cement (*second revision*).
§Specification for chemical resistant mortars : Part I Silicate type.
‖Recommendations for selection of industrial floor finishes.

4.4 Group IV — This group consists of the following sections:

a) Boiler room,

b) Refrigeration room,

c) Stores and godowns, and

d) Workshops.

4.4.1 These sections require good wear resistance and occassionally resistance to alkalies and very mild acidic conditions.

4.4.2 The choice of the floor finishes for these sections may be made from:

a) granolithic cement concrete (*see* IS: 5491-1969*),

b) power compacted concrete of Grade M 150 with iron chippings mixed with the aggregates, or

c) hydraulic pressed cement concrete tiles (*see* IS: 1237-1959†).

4.4.3 Wherever slippery conditions prevail, cement concrete tiles with chequered surface finish would be suitable. Where *in situ* concrete is provided and non-slip surface finish is desired, a hard abrasive material, such as silicon carbide or aluminium oxide may be sprinkled evenly on the concrete surface at the rate of 2 kg/m^2 and worked into the surface by power floats and in the final steel trovelling. Iron particles may also be used in the same way to increase the wear resistance of the surface.

4.5 Group V — This group consists of chemical stores for storage of concentrated acid and other chemicals.

4.5.1 Ceramic unglazed vitreous acid resistant tiles conforming to IS: 4457-1967‡ or acid resistant bricks conforming to IS: 4860-1968§ may be used.

5. WATERPROOF MEMBRANE FOR DAIRY FLOORS

5.1 The floor finish provided in any section of the dairy should necessarily prevent the leakage of effluents to the base concrete. To install a permeable floor finish is dangerous as the point of attack is not visible. Even more dangerous than the attack of the concrete is the possibility of corrosion of reinforcement in a suspended floor. Inspite of the care taken, some of the floor finishes sooner or later may allow leakage. Precaution therefore shall be taken by providing a watertight membrane as a second line of defence. This membrane should be

*Code of practice for laying *in situ* granolithic concrete floor topping.
†Specification for cement concrete flooring tiles.
‡Specification for ceramic unglazed vitreous acid-resistant tiles.
§Specification for acid-resistant bricks.

resistant to all mild acid and alkalies. The membrane should be designed in such a manner that it should shed any liquid into the drain by shortest route and not allow it to permeate the walls. The most common membrane is acid resistant bitumen mastic laid on a layer of saturated bitumen felt (*see* IS:1322-1970*) or fibre glass based saturated bitumen felt (*see* IS:7193-1974†). This provision isolates the membrane from the building so that the material does not move with the base. For details of laying bitumen mastic floor (*see* IS:1196-1968‡).

6. DRAINAGE IN DAIRIES

6.1 Correct drainage system is necessary for satisfactory performance of all types of floor finishes. All floor finishes however well laid, invariably have small areas slightly below the general level. If the floor is not sloped these pockets collect liquid in shallow pools which eventually become centres of deterioration to the floor finish and the the base concrete. However, in providing slope to the floor, safety and convenience of the movements of trucks, trolleys and workmen should be taken into consideration. If the floor finish is smooth and even, and if there is truck movements but little spillage a fall of 1 in 80 is adequate. If the floor finish is rough, or if there is little truck movements but much spillage, a slope of 1 in 40 would serve the purpose.

6.2 There are three methods of arranging the drainage as given below:

a) The floor finish may slope from each of the side walls into a centre channel which runs along the length of the building or from the centre of the floor to the side wall channels.

b) The floor finish may be laid in bays with channels across the width of the building.

c) The floor may be divided into a series of rectangular troughs each with a central drain.

6.3 The drains should be of sufficient capacity to carry away all the waste liquids. All floor drainage should be open channel covered by a grid, discharging into an ordinary closed drain. The drains should be as close as possible to the main source of spillage; should be as far away as possible from any source of vibration, and from any load bearing member. They should not pass above any major item of equipment in case they leak and damage it.

6.4 The edges and corners of the floors and drains should be rounded off to prevent dirt from harbouring there.

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*Specification for bitumen felts for waterproofing and damp-proofing (*second revision*).

†Specification for glass fibre base coal tar pitch and bitumen felts.

‡Code of practice for laying bitumen mastic flooring (*first revision*).

6.5 The most suitable material for the drains is the chemically resistant salt glazed pipes and similar chemical resistant tiles. The joints should be made with a chemical resistant resin mortar.

7. MAINTENANCE OF DAIRY FLOORS

7.1 Regular cleaning of dairy floors is essential for hygiene, safety and for long life of the floor. In some areas, the floors should be scrubbed several times a day to remove milk waste and grit which not only causes insanitary and slippery conditions but may also be deterimental to the floor finish. Destructive agents like lactic acid are formed as milk sours so that early removal of spilled milk is particularly desirable. There are numerous types of cleaning agents available, some of which are combinations of soaps, synthetic detergent or various chemicals which are designed for the conditions existing in dairies. The use of straight soaps is not recommended since they tend to precipitate insoluble salts if the water is hard or if acidic or alkaline solutions exist, resulting in the deposition of a slippery film on the floor if rinsing is not thorough. A definite amount of scrubbing with brushes or electric scrubbing machines should be used followed by rinsing with clean water and then drying. Detergents that merely need to be sprinkled on the floor and then washed are often found to be strong enough to damage the floor surface. Only neutral or mild detergents with a low free sulphate content should be used for cleaning purposes. Steam cleaning or high pressure water may be used to remove wastes, and in some cases a continuous flow of low velocity water may be used to wash harmful wastes down the drains.

7.1.1 It is advisable to use drip trays under machines to limit the areas of the floor exposed to the action of the milk. The corrosive cleaning solutions from equipment should be directly taken to the drains through pipes and prevent them in coming into contact with the floor. Link mats which consists of small rubber units held apart by a stainless steel wire may be used for safety purposes in slippery and wet areas, but they should be thoroughly washed along with the floor.

7.1.2 In areas subjected to trucking a crust of dirt should not be allowed to accumulate since trucks and carts ride unevenly over these obstructions imposing undue impact stresses on the floor finish. The placing of rubber mats in areas where impact is severe will prolong the life of the floor finishes not resistant to the conditions.

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